

Patterns in Deep Sea Coral and Sponge Communities of Olympic Coast 2019

NOAA Ship Bell M. Shimada, Research Cruise SH-19-07

September 10-16, 2019

Quick Look Report

30 October 2019



Field work and data analysis supported by NOAA's Deep Sea Coral Research and Technology Program and key partners through the West Coast Deep Sea Coral Initiative, FY18-FY21.

Cruise Summary

The goal of the 7 day mission aboard NOAA Ship *Bell M. Shimada* (*Shimada*) was to survey priority seafloor locations within and adjacent to Olympic Coast National Marine Sanctuary (OCNMS; **Figure 1**). Specific research objectives included: (1) conducting standardized quantitative visual transects of various seafloor habitat types in and around the Olympic 2 Essential Fish Habitat (EFH) Area using remotely operated vehicle (ROV) *Beagle*, an undersea robot owned and operated by Marine Applied Research and Exploration (MARE), (2) conducting CTD casts and plankton surface trawls using bongo nets in areas adjacent to four OCNMS long-term oceanographic moorings, and (3) recovering and re-deploying an acoustic mooring (Noise Reference Station 03, or NRS03) just outside OCNMS in 950m of water depth in lower Juan de Fuca Canyon. Each of these objectives were completed in full, with the exception of two OCNMS mooring sites that were originally targeted for nighttime CTD casts and bongo tows; due to poor weather conditions, CTDs and plankton sampling at Makah Bay and Teahwhit Head were not completed. The ROV conducted visual surveys over two different major seafloor features of interest, both of which lie mostly inside Olympic 2 EFH.

While on transect, at least 15 different species of deep sea corals were preliminarily observed (**Table 1**). A total of 19 timed transects were completed during 5 ROV dives (**Table 2**) that captured more than 20 hours of video and thousands of still images of the benthic habitat (**Figure 2**). In addition to numerous species of deep sea corals observed on the video, many different species of sponges, other invertebrates

such as octopus, crabs, and commercially harvested fish species were also noted. Twelve samples of various deep-sea coral and sponges were collected by the ROV and preserved in ethanol for use in genetic studies (**Table 3**). Outside of the visual surveys, 6 bongo tows and two CTD casts were completed near two of the four targeted long-term oceanographic mooring locations (Cape Alava and Cape Elizabeth). In addition, the existing NRS03 was successfully recovered and replaced with a new mooring and hydrophone to record underwater sounds adjacent to OCNMS for approximately the next 24 months.

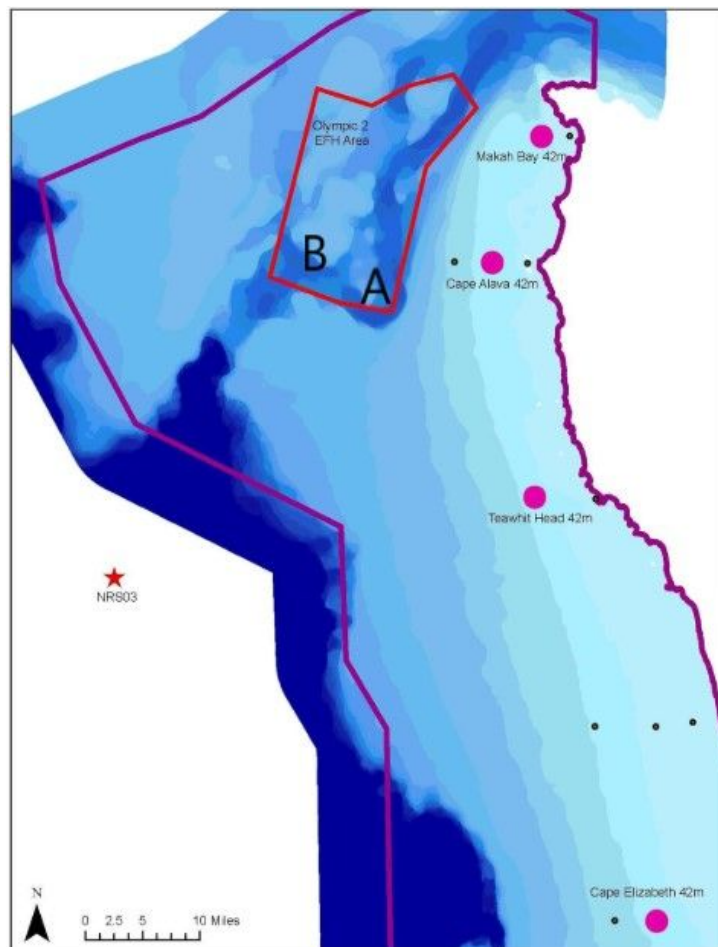


Figure 1: Map of the study area in Olympic Coast National Marine Sanctuary (purple outline) off the Washington coast. Olympic 2 Essential Fish Habitat is outlined in red; targeted seafloor features are indicated by the letters A and B; OCNMS long-term oceanographic mooring locations are indicated by pink circles; Noise Reference Station 03 is indicated with a red star.

The majority of visual seafloor surveys were conducted in previously unexplored areas and in Olympic 2 EFH; both are top research priorities for the West Coast Deep Sea Coral Initiative (WCDSCI) through which the cruise was funded. The WCDSCI is supported by NOAA's Deep Sea Coral Research and Technology Program (DSC RTP), and the majority of observations of deep sea corals and sponges will be analyzed and submitted to the [DSC RTP's National Database](#). The database is publicly accessible and built to provide information for U.S. regional fishery management councils as well as other resource managers. Data collected by the team will not only inform sanctuary management on a local level, but also fishery management on regional and national levels. Samples collected by the ROV will be used to properly identify several species observed during visual surveys, as well as to provide data for population and connectivity studies occurring in the West Coast Region.

Table 1: Coral species observed during SH-19-07 in Olympic Coast National Marine Sanctuary.

Species name	Dive(s) # observed	Relative abundance**	Sampled?
<i>Calcigorgia cf. spiculifera</i>	2	Occasional	Yes, Dive 2
<i>Calcigorgia</i> sp.	1, 2, 3, 4, 5	Occasional	Yes, Dive 1
<i>Clavularia</i> sp.	1	Rare	No
<i>Desmophyllum dianthus</i>	1, 2, 4, 5	Common	No
<i>Lillipathes</i> sp.*	1	Rare	No
<i>Lophelia pertusa</i>	2	Occasional	No
<i>Halipteris</i> sp.	2, 3, 4, 5	Common	No
<i>Paragorgia</i> sp.	1, 2, 4, 5	Common	Yes, Dive 1
<i>Plumarella longispina</i>	1, 2, 4, 5	Common	Yes Dives 1, 4
<i>Primnoa pacifica</i>	2, 5	Rare	No
<i>Stylaster</i> sp.	4	Common	Yes, Dive 4
<i>Stylatula</i> sp.	3, 4	Rare	Yes, Dive 3
<i>Swiftia simplex</i>	2	Occasional	No
<i>Swiftia cf. pacifica</i>	1, 2, 3	Common	Yes, Dive 1
<i>Swiftia spauldingi</i>	1	Rare	No

* Requires video confirmation

** Relative abundance scale: Rare, Occasional, Common, Abundant. Definitions based on Gittings, S.R., T.J. Bright, W.W. Schroeder, W.W. Sager, R. Rezak, and J.S. Laswell. 1992. *Biotic assemblages and ecological controls on topographic features in the northeast Gulf of Mexico*. Bull. Mar. Sci. 50(3):435-455.

Table 2. Summary of ROV Beagle dives conducted in Olympic Coast National Marine Sanctuary, 2019

Cruise ID	Dive #	Date	Site	In Water Time	In Water Position	On Bottom Time	On Bottom Position	Off Bottom Time	Off Bottom Position
SH-19-07	1	13 Sept	Rainbow Ridge S	15:25	47.7570, -125.5039	15:50	48.1059, -125.0661	22:09	48.1056, -125.0477
SH-19-07	2	14 Sept	Rainbow Ridge N	02:06	48.1046, -125.0474	02:38	48.1274, -125.	08:30	48.1311, -125.0761
SH-19-07	3	14 Sept	Hourglass South	17:38	48.1704, -125.1813	17:59	48.1709, -125.1800	22:42	48.1712, -125.1603
SH-19-07	4	15 Sept	Rainbow Ridge NE	15:25	48.1709, -125.1624	15:51	48.1448, -125.0387	18:06	48.1554, -125.0412
SH-19-07	5	15 Sept	Rainbow Ridge N	19:14	48.1552, -125.0470	19:34	48.1261, -125.0302	22:43	48.1321, -125.0417

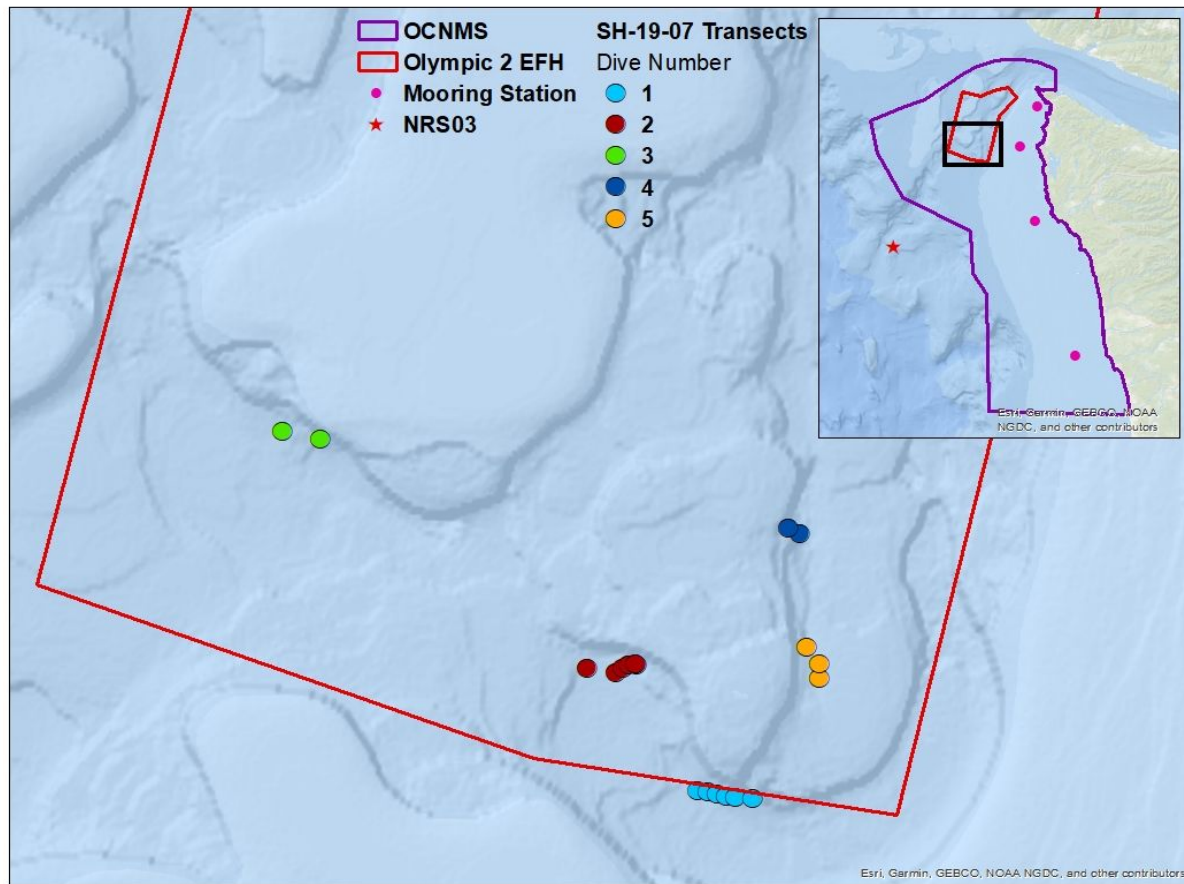


Figure 2: Sites targeted for quantitative visual transects with ROV Beagle, CTD casts and bongo net tows during the SH-19-07 mission on NOAA Ship Bell M. Shimada. Individual transects are indicated by circles and color-coded by dive. Rainbow Ridge is the feature in the lower right hand corner with multiple, clustered transects (dives 1, 2, 4, 5). Two transects indicated by green circles were surveyed on the south flank of a seafloor feature referred to as the Hourglass, just northwest of Rainbow Ridge.

Table 3. Log of specimens collected by the ROV Beagle during SH-19-07.

Site	Dive #	Date	Time (UTC)	Depth (m)	Latitude	Longitude	Shipboard ID
Rainbow Ridge S	1	9/13/19	16:12	255	48.1070	-125.0647	Paragorgia sp.
Rainbow Ridge S	1	9/13/19	17:21	247.5	48.1064	-125.0629	<i>Calcigorgia</i> sp.
Rainbow Ridge S	1	9/13/19	17:40	24.5	48.1064	-125.0628	<i>Swiftia</i> cf. <i>pacifica</i>
Rainbow Ridge S	1	9/13/19	19:48	166	48.1065	-125.0578	Finger sponge
Rainbow Ridge S	1	9/13/19	20:20	270	48.1049	-125.0568	<i>Plumarella longispina</i>
Rainbow Ridge N	2	9/14/19	03:56	304	48.1288	-125.0975	<i>Calcigorgia</i> cf. <i>spiculifera</i>
Rainbow Ridge N	2	9/14/19	06:00	214	48.1295	-125.0850	<i>Acarnus</i>
Rainbow Ridge N	2	9/14/19	06:48; 06:54	206	48.1304	-125.0837	Glass sponge (2 fragments)
Hourglass South	3	9/14/19	19:41	134	48.1731	-125.1719	<i>Latunculia</i>
Hourglass South	3	9/14/19	19:48	134	48.1730	-125.1719	Stylatula sp.
Rainbow Ridge NE	4	9/15/19	16:07; 16:15	259	48.1504	-125.0398	<i>Stylaster</i> sp (2 individuals)
Rainbow Ridge NE	4	9/15/19	16:39	229	48.1533	-125.0434	<i>Plumarella</i>

Event and Dive Log

General Dive Summary

Under the guidance of MARE staff, ROV *Beagle* conducted five dives between Sept. 13-16. During each dive, visual transects were conducted along several survey lines. The survey lines were drawn to guide the ROV pilot across a range of habitat types, or seafloor topologies, within a seafloor feature of interest where mapping data indicated hard bottom and/or complex topology (targeted habitats included sandy mudflats, gentle to steep-sloping ridge faces, to the top or plateau of a feature). Within each survey line, between two and six 15 minute transects were conducted where the ROV maintained a fixed speed, orientation, and altitude above the seafloor for later quantitative analyses of observed coral, sponge, fish, and other invertebrates. Four of the five dives focused on a feature referred to here as Rainbow Ridge, and a single dive surveyed a separate feature referred to as the Hourglass (**Figure 2**).

During each dive, scientists observed hard bottom that consisted of cobbles and mixed size boulders scattered across the seafloor, with Rainbow Ridge consisting of steeper, more vertical rock faces in places. Generally, the greatest variety and abundance of coral and sponge species were observed in a depth range between 200-290 meters, and they typically occurred on steeply sloping to vertical ridges and boulder faces. Across sites, the most abundant coral species preliminarily observed included *Calcigorgia*, *Halpterus*, and *Paragorgia*. In some locations, there were large patches of corals belonging to the genus *Swiftia*. On two occasions, individual *Primnoa* colonies were observed both on and off transect, growing on the side of large boulders. On the steepest of ridge faces, seen only on the Rainbow Ridge feature, *Lophelia* colonies were observed and often adjacent to many, and sometimes very large, individuals of *Desmophyllum*. Generally, when hard bottom was present (from cobble to tall ridge faces), scientists most commonly observed flat plate, finger, barrel, and vase sponges. The fish species most frequently encountered included rose thorn, sharp chin, red banded, green striped, yellow eye, and thorny head rockfishes, as well as many halibut and other flatfish species. Spiny dogfish, pink urchins, box crabs, sea stars (especially *Pycnopodia helianthoides*), and seapens were also encountered fairly frequently over sandy mudflat and cobble substrates. Images of observed species appear in Figures 3-7.

SH-19-07 Event Log

Day 1 - 9/10 The ship's crew, contract staff, and science party completed mobilization and began transit to OCNMS around 6 pm PST. Science and ROV teams completed training en route.

Day 2 - 9/11 Once the ship reached NRS03 in the afternoon, the team from PMEL recovered an existing hydrophone mooring and redeployed a new station to continue collecting acoustic data. In late evening of day 2 and early morning of day 3, a CTD cast and bongo tows were conducted near Cape Elizabeth.

Day 3 - 9/12 Weather prevented the science and ROV teams from launching the *Beagle* and the ship sought refuge nearshore.

Day 4 - 9/13 Visual surveys using the ROV were conducted at a location referred to as Rainbow Ridge. Two dives (dive 1 and 2) were completed at this site (North Rainbow Ridge and South Rainbow Ridge) with each dive consisting of six timed transects in depths ranging between 336 and 177 meters. Between transects, eight coral and sponge samples were collected by the ROV, processed and preserved on deck.

Day 5 - 9/14 One dive (dive 3) was completed on the second seafloor feature of interest, referred to as Hourglass, in relatively shallow depths that ranged between 177 and 144 meters. Two transects were completed, and two samples were collected. In the late evening and into the early morning, a CTD cast and bongo tows were conducted near Cape Alava.

Day 6 - 9/15 This was the last day to conduct field work before transit back to Newport, Oregon and two dives were completed on Rainbow Ridge (dive 4 and 5) that consisted of five timed transects ranging in depths between 270 and 195 meters. Two samples were collected and later processed and preserved. All science equipment was back on deck and secured for transit by 4pm PST before heading back to port.

Day 7 - 9/16 Ship arrived in Newport, Oregon for demobilization.

Highlight Images and Captions:

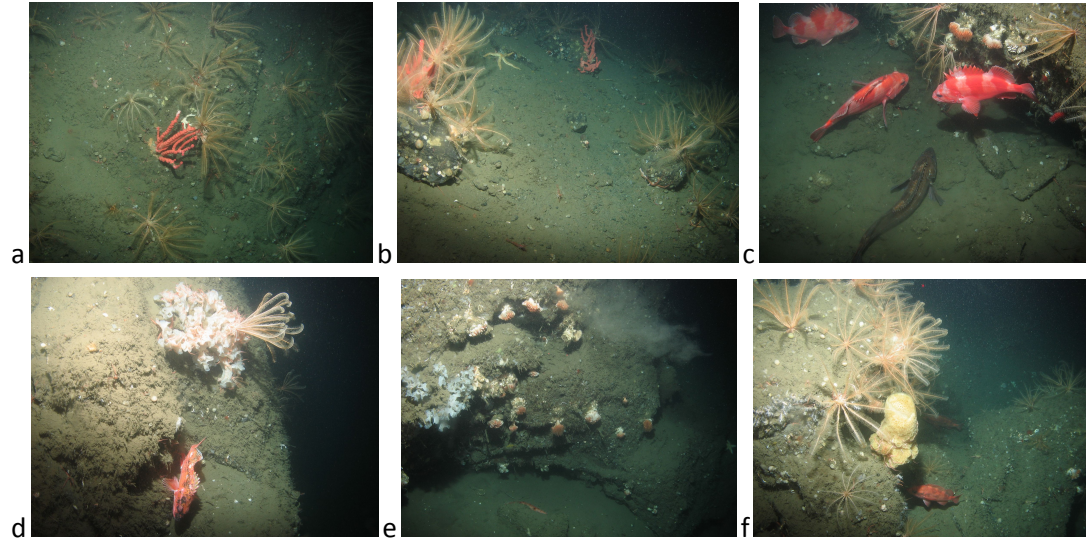


Figure 3. Highlight images from SH-19-07: Dive 1 on Rainbow Ridge South. a) *Paragorgia pacifica*, b) *Paragorgia pacifica*, c) *Desmophylum dianthus* corals surrounded by redbanded rockfish and a lingcod, d) *Farrea* sp. sponge with a rosethorn rockfish, e) *Desmophylum dianthus* corals and *Farrea* sp. sponge, f) *Mycale* sp. sponge and sharpchin rockfish.

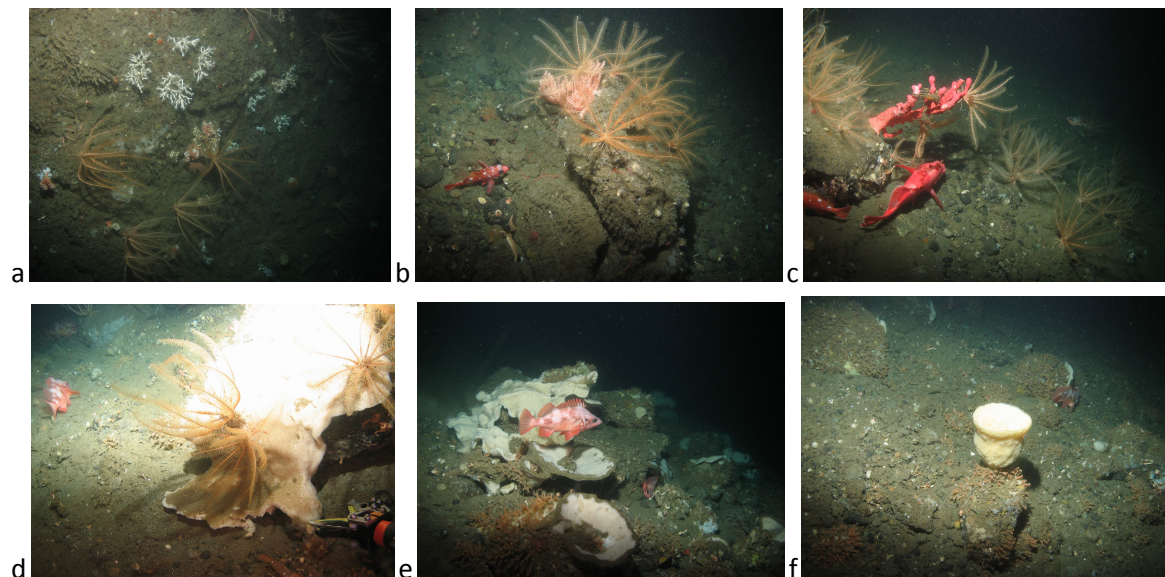


Figure 4. Highlight images from SH-19-07: Dive 2 on Rainbow Ridge North. a) *Lophelia pertusa* and *Desmophylum dianthus* corals on a cliff wall, b) *Primnoa pacifica* and rosethorn rockfish, c) *Paragorgia pacifica* and redbanded rockfish, d) glass sponge collection and rockfish, e) *Poecilastra* sp. sponge and sharpchin rockfish, f) *Mycale* sp. sponge.

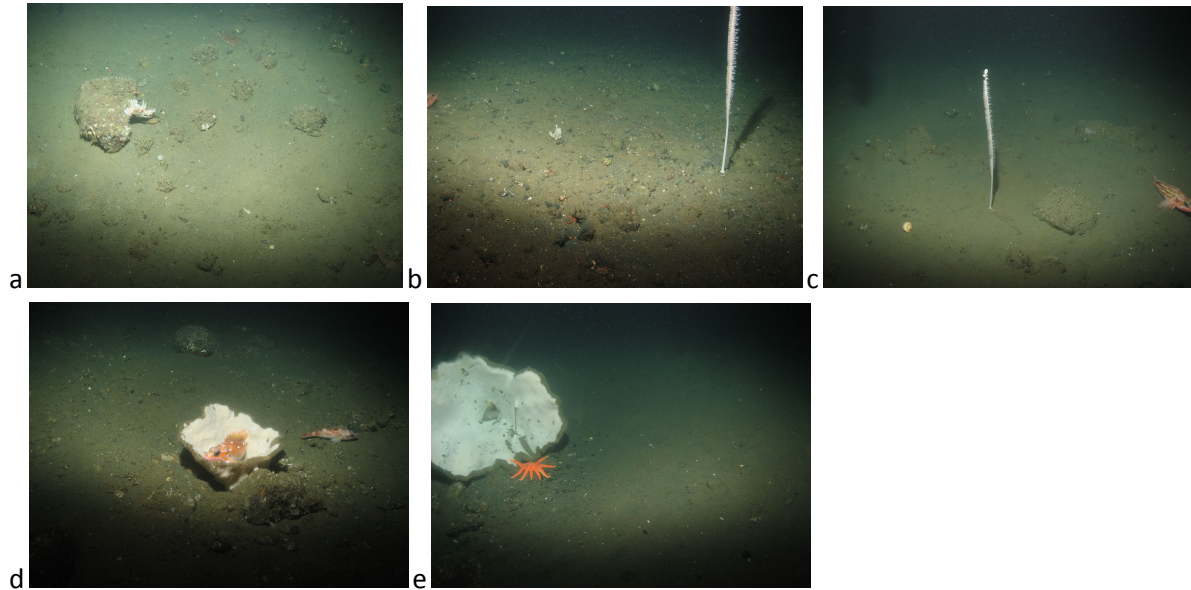


Figure 5. Highlight images from SH-19-07: Dive 3 on Hourglass South. a) Finger sponge, b) *Halipteris willamosi*, c) *Halipterus willamosi* and greenstriped rockfish, d) *Poecilastra* sp. sponge and rockfish, e) *Poecilastra* sp. Sponge.

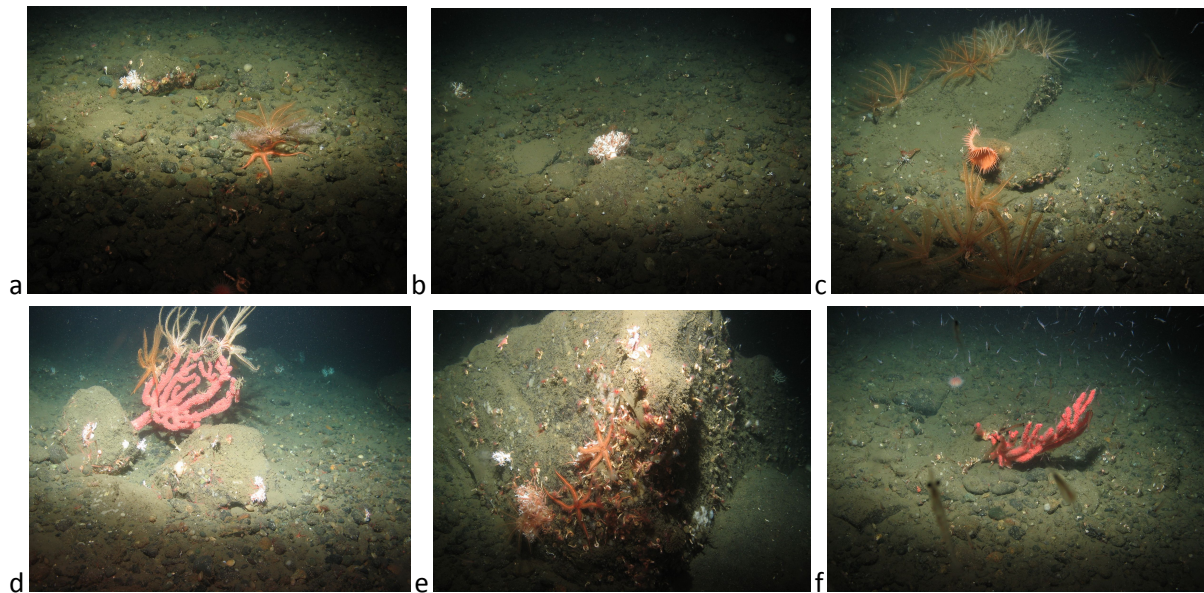


Figure 6. Highlight images from SH-19-07: Dive 4 on Rainbow Ridge Northeast. a) *Stylaster* sp. and *Plumarella longispina*, b) *Stylaster* sp., c) Flytrap anemone, d) *Paragorgia pacifica*, e) *Stylaster* sp., f) *Paragorgia pacifica*.

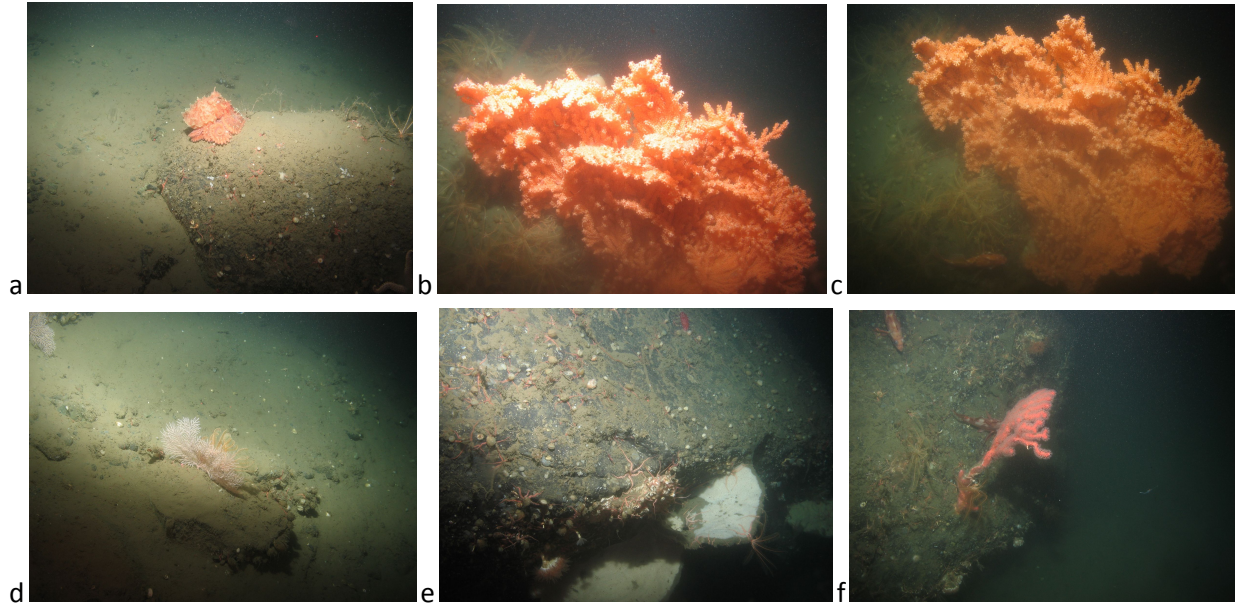


Figure 7. Highlight images from SH-19-07: Dive 5 on Rainbow Ridge Northeast. a) Giant Pacific octopus, b) *Primnoa pacifica*, c) *Primnoa pacifica* and rockfish, d) *Plumarella longispina*, e) *Poecilastra* sp. sponge, f) *Paragorgia pacifica*.

Acknowledgements

The success of this project is due to the efforts of NOAA's Deep Sea Coral Research and Technology Program and West Coast Deep Sea Coral Initiative, the officers and crew of the NOAA Ship *Bell M. Shimada*, the team from Marine Applied Research and Exploration and ROV *Beagle*, NOAA's Olympic Coast National Marine Sanctuary, and the eight women who comprised the science party. We are grateful for contributions from the Makah Tribe's Ocean Policy Council during expedition planning; this work was conducted in an area within which the Makah Tribe has protected treaty rights.



Science party members gathered on the fly bridge of the NOAA Ship *Bell M. Shimada* as the expedition departed Newport, Oregon around sunset on 10 September 2019.